* NOTICES *

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the mixer circuit which oppresses an image frequency component, and the semiconductor integrated circuit which carried it in the portable telephone which used it, and the list, and is related in the suitable mixer circuit for the common portable telephone which can be used properly according to two or more sorts of especially different frequency bands and modulation techniques.

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PRIOR ART

[Description of the Prior Art] Recent years, GSM (Global system for mobile communications: worldwide magnitude mobile communication system), DCS1800 (Digital cellular system: digital partition system), PCS1900 (Personal communications system: individual communication system), PDC (Personal digital cellular 900/1500: individual digital partition system), AMPS (Advanced mobile phone service: the newest mobile radiotelephone service), Are represented by TACS (Total access communications system: comprehensive connection communication system) etc. The analog digital method cellular-phone system using the cellular-phone terminal of dc-battery actuation is continuing development increasingly, and is in the trend which does not know the place at which the high performance-ized demand of a pocket communication terminal also stops in connection with this.

[0003] And corresponding to the increment in such an assigned frequency band or system classification, common machines, such as a "dual band machine" which can talk two sorts of frequency bands over the telephone, and a "dual mode machine" which can be equivalent to two more sorts of different systems (a different modulation technique), appear by one set of a cellular-phone terminal, and, recently, the demand to a miniaturization and high-performance-izing of a circuit just increases **** in connection with this.

[0004] by the way, when realizing such a common machine, from the standpoint which controls the increment in circuit magnitude It is common to make from an antenna to a mixer circuit a wave number band response two or more rounds, and to use it in common about IF (Immediate Frequency: intermediate frequency) circuit after a mixer circuit. Therefore, henceforth [mixer circuit], two lines should just change in a part of demodulator circuit with "a dual mode machine, for example, the common machine of AMPS (FM modulation) and PCS1900 (GMSK modulation),."

[0005] Such a cellular-phone terminal corresponding to a dual band shows an example of the mixer circuit currently used from the former to drawing 8 R> 8. The mixer circuit 100 shown in this drawing 8 is constituted from the office input section 8 by two RF (Radio Frequency: high frequency) input sections 1 and 2, multipliers (for example, Gilbert Cell) 3 and 4, an adder 5 and IF input section 6, the office dispatch number distributor 7, and it, and enables it to correspond to two bands of GSM (900MHz band) and DCS1800 (1800MHz band) by this.

[0006] And the 900MHz RF signal RFin inputted into one input of each multipliers 3 and 4 from each input sections 1 and 2 (1) The 1800MHz RF signal RFin (2) is supplied the same, respectively. To the input of another side Station dispatch number LOin which was inputted from the input section 8 from a station, and was distributed by the station dispatch number distributor 7 It supplies, the output is added with an adder 5 in each, and the 450MHz intermediate frequency signal IFout is outputted from IF output section 6.

[0007] In this case, generally, an adder 5 serves as a collector addition method only by connection of wiring, and becomes twice one mixer circuit as the number of circuits (component). Moreover, since a matching circuit (filter) is surely required for RF input sections 1 and 2, and two or more lines of this matching circuit are required when inputting a different frequency, generally it is made such circuitry.

[0008] Drawing 9 is an example of the common machine corresponding to a dual band, and while was received by the antenna 19. A band a signal, for example, a 900MHz RF signal It is inputted into the filter 20 of the first rank, amplifier 21, and it through the latter filter 22 at RF input section 1 of a mixer circuit 100. The RF signal of the band of another side, for example, a 1800MHz RF signal, is inputted into the filter 23 of the first rank, amplifier 24, and it through the latter filter 25 at RF input section 2 of a mixer circuit 100.

[0009] And for example, it was outputted from IF output section 6 of a mixer circuit 100, the 450MHz intermediate frequency signal IFout is inputted into the recovery section 27 through a filter 26, and after getting over and being processed in the signal-processing section 28, it is supplied to a loudspeaker 29.

[0010] On the other hand, the sound signal inputted into the signal-processing section 28 will be supplied to the modulation section 32, will turn into a modulated RF signal from a microphone 30, the transmitting amplifying circuit 33 will be supplied, and it will be transmitted as an electric wave from an antenna 19. Station dispatch number LOin currently supplied to the mixer circuit 100 from the local oscillator 31 at the modulation section 32 at this time It is supplied and, thereby, transmit frequencies are specified.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Consideration was not carried out about the point that the preceding paragraph of a mixer circuit takes the filter of high performance, but the above-mentioned conventional technique had a problem in buildup-izing and cost lifting of circuit magnitude accompanying a dual band response. Hereafter, if this point is explained in detail, as described above, now, for example If IF frequency is set to 1350MHz supposing the common machine of a 900MHz band (GSM) and two frequency bands of a 1800MHz band (DCS1800), 450MHz and the frequency from a station At this time, generally, in order to oppress an unnecessary interference out of band, equipment of the filter of a quite steep property becomes indispensable as filters 20, 22, 23, and 25 of the preceding paragraph of the mixer circuit 100 shown in drawing 9 .

[0012] Moreover, when the high frequency band side filters 23 and 25 are the same filter formats and the same magnitude (configuration) compares in this case, as compared with the filters 20 and 22 by the side of a low frequency band, usually becomes that in which the oppression property out of band was generally inferior.

[0013] Then, on the occasion of a dual band response, a dielectric filter and the filter with which the steep and big magnitude of attenuation is obtained like a ceramic filter are needed insufficiently [the SAW (SurfaceAcoustic Wave: surface acoustic waves) filter usually used / a property]. Since mass production effectiveness was bad, as the deer was carried out and these dielectrics filter and the ceramic filter had the problem that a configuration will become large as compared with an SAW filter, and it described above as compared with the SAW filter, the problem that a price will also become high will arise.

[0014] Next, drawing 7 explains the interference component which becomes a problem especially here. Although the component of an interference changes with configurations of a receiving circuit, as shown in drawing on drawing 7 , it assumes the case of the double conversion method which carries out frequency conversion in two steps here using two mixers 40 and 41. In addition, in this drawing 7 , Hz which is the unit of a frequency is omitted, therefore M is MHz.

[0015] First, the 1st step of mixer 40 performs frequency conversion by the 1350MHz office dispatch number 43 (LO) into which 1800MHz RF signal 42 inputted from RF input section 2 as well as the multiplier 4 in the mixer circuit 100 of drawing 8 is inputted from the office input section 8, and outputs 450MHz IF signal 44.

[0016] Next, the mixer 41 of the 2nd step carries out frequency conversion of IF signal 44 which is the 1st step of output of a mixer 40 by the 2nd 500MHz station dispatch number 45 (LO2), and outputs 50MHz IF signal 46. In this case, it becomes the same frequency of 450MHz as IF signal 44 which is the output of the mixer 40 of the 1st step. 1st image signalling frequency 42a which is blocked to the wave of choice (First Image=LO-RF=900MHz), It becomes the same frequency (50MHz) as the output signal 46 (IF2) of the mixer 41 of the 2nd step. A kind of signal 42b in the 2nd image frequency which is blocked to the wave of choice (2= 800MHz of 2nd Image(1) =LO-LO2-IF), Since a kind of signal 42c (2= 1900MHz of 2nd Image(2) =LO+LO2+IF) which will accept it in the 2nd image frequency cannot be oppressed theoretically, it must be oppressed with the filter of the preceding paragraph from it in the usual mixer circuit.

[0017] Here about the RF signal by the side of a high frequency band (DCS1800) About the special frequency group which is in the range changed into the band of the wave of choice by frequency conversion of a mixer in a band 1705MHz [or less] and a band 1980MHz or more It is defined by specification that it can receive even when the interference of -43dBm power is inputted into the antenna of a cellular phone, therefore it fully needs to attenuate such a big signal to -100dBm - -110dBm in the mixer input section 2 as a flight model.

[0018] In order for image frequency 42a and a kind of frequency 42b of the 2nd image frequency to be in a kind of this special frequency group and to make it decrease these, if 70dB or more of magnitude of attenuation is made, 80dB or more of a certain things is needed for the filters 23 and 25 in the preceding paragraph by the side of the input section 2. A deer is carried out, since the magnitude of attenuation expectable in a general SAW filter is only about 30dB, even if it uses two steps of this, it will be insufficient, therefore 10dB - about 20dB is understood that it cannot but use a filter large [a dielectric filter, a ceramic filter, etc.] a configuration and expensive in the actual condition as mentioned above.

[0019] About other frequency 42c of a kind of of the 2nd image frequency, as the magnitude of attenuation with filters 23 and 25, although 10dB - about 20dB is needed, since it becomes near the receiving band in this case, whenever [oppression] will hardly be obtained, therefore the 10dB - 20dB magnitude of attenuation will be still more nearly insufficient also here.

[0020] The so-called image cancellation mixer circuit where oppression of such image frequency was obtained by the mixer circuit itself on the other hand is known from the former. As that name, this mixer circuit is a mixer circuit equipped with the function which oppresses image frequency, and has composition which added the adder etc. to two usual multipliers with the phase shifter about 90 degrees.

[0021] Supposing it carries out a deer and applies this image cancellation mixer circuit to the mixer circuit of a common machine, two multipliers are required only in one mixer circuit, if it is a dual band response for this reason, a total of three multipliers will be required and a word will increase [the number of circuit elements, and an area required for that arrangement] 1.5 times roughly. Moreover, since the adder of an output side serves as addition of three signals in this case, similarly wiring capacity increases 1.5 times and what the degradation by lowering of an output level will not escape can be guessed easily.

[0022] Without being accompanied by buildup of circuit magnitude, the object of this invention is to offer the mixer circuit where control of the interference by image frequency was fully obtained, and is to offer further the portable telephone with which high performance-ization was obtained by this mixer circuit.

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MEANS

[Means for Solving the Problem] In the mixer circuit of the method which receives the input signal which differs in two or more frequency bands using the adder adding the output of two or more multipliers which carry out the multiplication of an input signal and the station dispatch number, and the multiplier of these plurality, respectively, and outputs an intermediate-frequency signal, at the time of the input signal reception by one certain multiplier of said multiplier, an image cancellation mixer circuit is formed using one multiplier of further others, and the above-mentioned object is made and attained.
[0024] In the common machine which operates with two or more frequency bands, while the multiplier corresponding to the signal of each frequency band exists in a mixer circuit and operating with which frequency band, multipliers other than a corresponding multiplier are in the condition of playing. Then, it enables it to oppress the interference of image frequency in this invention, without using this together, and hitting on an idea paying attention to existence of the idle multiplier in this common machine, that an image cancellation mixer should be constituted, consequently being accompanied by buildup of circuit magnitude.
[0025]
[Embodiment of the Invention] Hereafter, the operation gestalt of a graphic display explains this invention to a detail. Although drawing 1 is 1 operation gestalt of the mixer circuit by this invention, 100a of a mixer circuit and 10 is [an input signal distributor and 11] adders in drawing, and other configurations are the same as the mixer circuit by the conventional technique shown in drawing 8 as long as it saw with a block In this mixer circuit 100a, it replaces with the adder 5 in the mixer circuit 100 of drawing 8 , and adder 5a is prepared, similarly it replaces with the office dispatch number distributor 7, and office dispatch number distributor 7a is prepared.
[0026] Adder 5a consists of adder circuits which equipped one side of the two input path with the phase-shifting circuit of 90 degrees, and carries out the work adding the output signal of the multiplier 3 of a 900MHz band, and the signal which carried out the phase shift of the output of the multiplier 4 of a 1800MHz band 90 degrees. Station dispatch number adder 7a serves to carry out 90-degree phase shift of the 1350MHz station dispatch number, and to supply it to a multiplier 4 while it consists of circuits which equipped one side of the two output path with the 90-degree phase-shifting circuit and supplies a 1350MHz station dispatch number to a multiplier 3 as it is.
[0027] A distributor 10 serves to distribute the RF signal supplied from the input section 2 by the side of a high cycle band to a multiplier 4 and the input signal adder 11, respectively, and to supply it. The input signal adder 11 serves to mix the RF signal supplied from the input section 1 by the side of a low frequency band, and the RF signal by the side of the high cycle band supplied through a distributor 10, and to input into a multiplier 3.
[0028] Therefore, although mixer circuit 100a of this drawing 1 is 2 band response of GSM by the side of the low frequency band same with the mixer circuit 100 of the conventional technique shown in drawing 8 (900MHz band), and DCS1800 (1800MHz band) by the side of a high frequency band Although it becomes the same actuation as the conventional technique to the RF signal of GSM by the side of a low frequency band (900MHz band) at this time As opposed to the RF signal of DCS1800 (1800MHz band) by the side of a high frequency band It will operate as the above-mentioned image cancellation mixer circuit, and this oppresses 1st image frequency 42a and the 2nd image frequency 42b and 42c which were explained by drawing 7 .
[0029] if gain of the active jamming signal omegaIF (unwanted) and the multiplier which lap VImage and a station dispatch number with VLO and the wave of choice in 1st image signalling frequency 42a is now set to K here -- VImage=Acos (omegaImage-t) .... .. (1) VLO=Bcos (omegaLO-t) .. .. (2) omegaIF(unwanted) =omega LO-omega Image .. .. it is set to (3).
[0030] If it does so, the output V1 of the 1st multiplier 3 will become as the following (4) types.
V1=A1 cos (omegaImage-t) and B1 cos (omegaLO-t), K1 = A1, B1, and K1/2, [cos{(omega Image+omega LO), and t} + cos {(omega Image-omega LO) -t}] =(A1, B1, K1) /2- [cos{(omega Image+omega LO) -t} +cos{omegaIF-t}] .... .. (4) [0031] Moreover, the output V2 of the 2nd multiplier 4 becomes as the following (5) types.
V2=A2 cos (omegaImage-t) and B-2 cos (omega LO-t+pi / 2), K2 = A2, B-2, and K2/2, [cos{(omega Image+omega LO) and t+pi / 2} + cos {(omega Image-omega LO) - t-pi / 2}] =(A2 and B-2, K2)/2 and [cos{(omega Image+omega LO) - t+pi / 2} +cos -- {(omega IF-t+pi / 2}] ..... (5) [0032]) Next, if it sees in the output of adder 5a about the active jamming signal component VIF (unwanted) which laps with the wave of choice, this will become the component which consists only of the 2nd term of (4) types and (5) types. Then, considering the actuation to this component, it becomes the following (6) types.
VIF(unwanted) =V1+V2**90=0 .... .. (6)
Therefore, it turns out that 0, i.e., this signal 42a, is oppressed, and the magnitude of signal 42a of the 1st image frequency is not changed into the frequency of the wave of choice. The same is said of the 2nd image frequency 42b and 42c.
[0033] By the way, in order to materialize (6) types in this case so that clearly from (4) types and (5) types, the following (7) types serve as requirements.
A1 and B1 -K1=A2, B-2, and K2 .... .. it is an indispensable condition for (6) type formation in (7), i.e., this operation gestalt, that the phase precision in each part can be taken exactly.
[0034] And the amplitude precision of two signals of the input signal distributor 10, phase precision and the amplitude precision of two signals of office dispatch number distributor 7a, phase precision, the gain precision of multipliers 3 and 4, and when the phase precision in 2nd adder 5a corresponds further and these are all satisfied, in mixer circuit 100a of drawing 1 , whenever [image about 40dB - 60dB oppression] is obtained by this condition.
[0035] By the way, in this way, when mixer circuit 100a by the operation gestalt of this invention is used, the 40dB - 60dB magnitude of

attenuation can be obtained by this mixer circuit 100a itself. On the other hand, as described above, in the case of the common machine shown in drawing 9 , the magnitude of attenuation required for the filters 23 and 25 of the input section 2 by the side of a high frequency band is 70dB - 80dB, and the magnitude of attenuation of another side and a general SAW filter is about 30dB.

[0036] It can fully respond to a common machine, without fully being able to oppress signal 42a of the 1st image frequency, and the signals 42b and 42c of the 2nd image frequency, consequently using an expensive filter in big configurations, such as a dielectric filter and a ceramic filter, according to the operation gestalt of this invention, even if it will use a general SAW filter as filters 23 and 25 when this mixer circuit 100a is used if it does so.

[0037] And with this operation gestalt, the actuation by the side of a high frequency band is faced. Since the multiplier 3 by the side of a low frequency band is shared as some components of the mixer circuit by the side of a high frequency band Since it will end also with the case corresponding to a dual band with a total of two multipliers, and the increment in the number of circuit elements and an area required for the arrangement can be suppressed certainly and there is also no increment in the number of addition of the signal in the adder of an output side, fear of lowering of an output level is not produced, either.

[0038] By the way, although it constitutes from an operation gestalt of drawing 1 so that the actuation which is made to form an image cancellation mixer circuit only to one input between two RF-signal inputs, and oppresses an image frequency component may be obtained An image cancellation mixer circuit may be made to form also to any of an input, and since the mixer circuit which is not surely used exists in another side, you may constitute from such a common machine so that the actuation which oppresses an image frequency component may be obtained.

[0039] Moreover, with the operation gestalt of this drawing 1 , although the RF signal of DCS1800 (1800MHz band) inputted from the 2nd input section 2 is compounded to the RF signal of GSM (900MHz band) into which it is inputted from the 1st input section 1, the adder 11 is used. A deer is carried out, and a switch is used instead of this adder 11, two signals are changed, and you may make it input into a multiplier 3 in this invention. If a side [in the case of the operation gestalt carried out in this way, it is separated with a switch] is made into the 1st input section 1 side, since the impedance in this input can be brought close to opening infinite, the design of the matching circuit of the 1st input section 1 becomes easy, and can improve the engine performance easily.

[0040] Although it considered as the dual band response and the case of two RF-signal inputs was explained with the above-mentioned operation gestalt further again, you may make it three or more RF-signal input responses. In this case, actuation which oppresses an image frequency component in one line or two or more signal inputs will be carried out.

[0041] On the other hand, by the case corresponding to a dual band like the above-mentioned operation gestalt about the RF signal of GSM (900MHz band) inputted from the 1st input section 1 If it is made to operate as a usual mixer circuit only using the 1st multiplier 3 You may constitute so that supply of the current over component parts which are not used, such as the 2nd multiplier 4, may be turned OFF, and at the time of actuation by GSM (900MHz band), power consumption can be lessened in this case, and extension of the dc-battery operating time by energy saving can be obtained.

[0042] Furthermore, although it consists of above-mentioned operation gestalten so that an office dispatch number may be supplied from one set of a local oscillator 31 and may be distributed by the office dispatch number distributor 7, it is obvious that it has some office input sections if needed, and you may be distributed with some office dispatch number distributors if needed using two or more local oscillators.

[0043] Next, a point which drawing 2 is what showed mixer circuit 100b by the 2nd operation gestalt of this invention, and is different from mixer circuit 100a by the operation gestalt of drawing 1 Replace with 2nd adder 5a and adder 5b by which the phase-shifting circuit is arranged from the multiplier 3 to the input path is prepared. It replaces with station dispatch number distributor 7a, and is in the point that station dispatch number distributor 7b which similarly arranges the phase-shifting circuit for the output path over a multiplier 3 is prepared, and other configurations are the same.

[0044] In this mixer circuit 100b, the output V1 of the 1st multiplier 3 becomes as the following (8) types.

V1=A1 cos (omegaImage-t) and B1 cos (omega LO-t+pi / 2), K1 = A1, B1, and K1/2, [cos{(omega Image+omega LO) and t+pi / 2} + cos {(omega Image-omega LO) - t-pi / 2}] =(A1, B1, K1) /2- [cos{(omega Image+omega LO) - t+pi / 2} +cos{omegaIF-t}+pi/2] ..... (8)

[0045] Moreover, the output V2 of the 2nd multiplier 4 becomes as the following (9) types.

V2=A2 cos (omegaImage-t) and B-2 cos (omegaLO-t), K2 = A2, B-2, and K2/2, [cos{(omega Image+omega LO), and t} + cos {(omega Image-omega LO) -t}] =(A2 and B-2, K2) /2- [cos{(omega Image+omega LO) -t} +cos{omegaIF-t}] .... .. (9) [0046] And about the active jamming signal component VIF (unwanted) which laps with the wave of choice, it becomes the component which consists only of the 2nd term of (8) types and (9) types with the output of adder 5b, and this serves as the following (10) types.

VIF(unwanted) =V1**90+V2=0 .... .. (10) Follow. 0, i.e., this signal 42a, will be oppressed, the magnitude of signal 42a of the 1st image frequency will be changed into the frequency of the wave of choice, and this is the same also about the 2nd image frequency 42b and 42c. It turns out that all will be oppressed, consequently the same operation effectiveness as the operation gestalt of drawing 1 is acquired also according to the operation gestalt of this drawing 2 .

[0047] Next, a point which drawing 3 is what showed mixer circuit 100c by the 3rd operation gestalt of this invention, and is different from mixer circuit 100b by the operation gestalt of drawing 2 It replaces with station dispatch number distributor 7b, replaces with the input signal distributor 10 using the station dispatch number distributor 7 without a phase-shifting circuit, and is in the point that input signal distributor 10a which arranges the phase-shifting circuit for the output path over a multiplier 43 is prepared, and other configurations are the same.

[0048] And in this mixer circuit 100c, the output V1 of the 1st multiplier 3 becomes as the following (11) types.

V1=A1 cos (omegaImage-t) and B1 cos (omegaLO-t2), K1 = A1, B1, and K1/2, [cos{(omega Image+omega LO), and t} + cos {(omega Image-omega LO) -t}] =(A1, B1, K1) /2- [cos{(omega Image+omega LO) -t} +cos{omegaIF-t}] .... .. (11)

[0049] Moreover, the output V2 of the 2nd multiplier 4 becomes as the following (12) types.

V2=A2 cos (omega Image-t+pi / 2) and B-2 cos (omegaLO-t), K2 = A2, B-2, and K2/2, [cos{(omega Image+omega LO) and t+pi / 2} + cos {(omega Image-omega LO) -t} +pi/2] =(A2 and B-2, K2) /2- [cos{(omega Image+omega LO) - t+pi / 2} +cos{omegaIF-t}-pi/2] ..... (12) [0050] And it becomes the component which consists only of the 2nd term of (8) types and (9) types about the active jamming signal component VIF (unwanted) which laps with the wave of choice with the output of adder 5b, and this serves as the following (13) types as well as the above-mentioned (10) types.

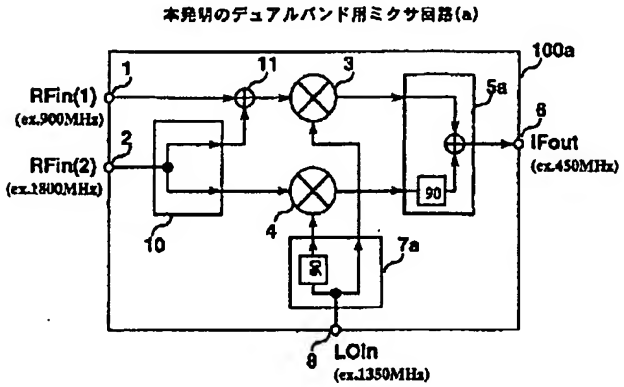
VIF(unwanted) =V1**90+V2=0 .... .. also according to (13), therefore the operation gestalt of this drawing 3 0, i.e., this signal 42a, will be oppressed, large ** of signal 42a of the 1st image frequency will be changed into the frequency of the wave of choice, and the same is said of the 2nd image frequency 42b and 42c. All will be oppressed, consequently the same operation effectiveness as drawing 1 and the

operation gestalt of drawing 2 can be acquired.
[0051] Furthermore, a point which drawing 4 is what showed 100d of mixer circuits by the 4th operation gestalt of this invention, and is different from mixer circuit 100c by the operation gestalt of drawing 3 It replaces with adder 5b which has a phase-shifting circuit for the output path of the multiplier 3 by the side of a low frequency band. Adder 5a which has a phase-shifting circuit is used for the output path of the multiplier 4 by the side of a high frequency band. It replaces with input signal distributor 10a which arranges the phase-shifting circuit for the path which results in a multiplier 43, and is in the point that input distributor 10b which has a phase-shifting circuit for the path which results in an adder 11 is prepared, and other configurations are the same.
[0052] And in the case of 100d of this mixer circuit, the output V1 of the 1st multiplier 3 becomes as the following (14) types.
V1=A1 cos (omega Image-t+pi / 2) and B1 cos (omegaLO-t2), K1 = A1, B1, and K1/2, [cos{(omega Image+omega LO) and t+pi / 2} + cos {(omega Image-omega LO) - t+pi / 2}] =(A1, B1, K1) /2- [cos{(omega Image+omega LO) - t+pi / 2} +cos{omegaIF-t}-pi/2] ..... (14)
[0053] Moreover, the output V2 of the 2nd multiplier 4 becomes as the following (15) types.
V2=A2 cos (omegaImage-t) and B-2 cos (omegaLO-t), K2 = A2, B-2, and K2/2, [cos{(omega Image+omega LO), and t} + cos {(omega Image-omega LO) -t}] =(A2 and B-2, K2) /2- [cos{(omega Image+omega LO) -t} +cos{omegaIF-t}] .... .. (15) [0054] Therefore, since it becomes the component which consists only of the 2nd term of (14) types and (15) types with the output of adder 5b about the active jamming signal component VIF (unwanted) which laps with the wave of choice, this serves as the following (16) types as well as the above-mentioned (6) types.
VIF(unwanted) =V1+V2**90=0 .... .. also according to (16), therefore the operation gestalt of this drawing 4 0, i.e., this signal 42a, will be oppressed, large ** of signal 42a of the 1st image frequency will be changed into the frequency of the wave of choice, and the same is said of the 2nd image frequency 42b and 42c. All will be oppressed, consequently the same operation effectiveness as the operation gestalt of drawing 1 - drawing 3 can be acquired.
[0055] Next, the example of the station dispatch number distributors 7a and 7b in the above-mentioned operation gestalt and the input signal distributors 10a and 10b is explained. In addition, since each of these divides one signal into two signals, it has the same function to carry out a phase shift and to output about 90 degrees of one signals and each of the internal-block configurations can be made [therefore] the same, the case where all are considered as the same configuration is only hereafter explained as a signal distribution box SD.
[0056] First, drawing 5 is an example of a frequency multiplier 50 and the signal distribution box SD constituted using the phase shifter 51 about 90 degrees. A frequency multiplier 50 inputs the station dispatch number supplied from the input terminal X, or the RF signal by the side of a high frequency band, and serves to change and output the frequency twice. About 90 degrees, a frequency inputs the signal which it doubled and carries out 1 / 2 dividing of this inputted signal, and the phase shifter 51 is distributed to two sorts of signals which shifted the phase about 90 degrees simultaneously, and serves to supply to each of two output terminals Y and Z.
[0057] As a circuit which distributes one signal to two signals, shifts the phase of the signal of one of these 90 degrees, and outputs it to the phase of the signal of another side here, it is common to use a phase shifter about 90 degrees. Then, since dividing of the frequency of the signal into which the signal distribution box SD of this drawing 5 was also inputted by the phase shifter 51 about 90 degrees in this case using the phase shifter 51 about 90 degrees will be carried out to one half, the frequency multiplier 50 has been formed further.
[0058] Next, drawing 6 is other examples of the signal distribution box SD in the mixer circuit of this invention (10a, 7a). As described above, this signal distribution box SD distributes the inputted signal to two signals of 0 times and 90 degrees as a function. Therefore, although it is thought that there is no degradation of C/N here since the signal of 0 times serves as a free line when it sees as a functional block diagram, the signal of 0 times will also surely pass along the phase shifter 51 about 90 degrees with a frequency multiplier 50, and a actual circuit can consider degradation of big C/N, as shown in drawing 5 and drawing 6 .
[0059] On the other hand, by the system of GSM (900MHz band), on the frequency left 3MHz to the signal of choice, even if it inputs the active jamming signal of the big power of 76dBc, to be able to receive is demanded as specification. In this case, the thing which the active jamming signal itself is turned up and lapped with the frequency of the signal of choice Although it is satisfactory since it is strictly prescribed by another specification, if C/N of an active jamming signal or the station dispatch number poured into a mixer circuit is bad Since 76dBc(s) have also inputted the active jamming signal of big power, there is a possibility that the noise level of the "skirt" which separated 3MHz from the center frequency of an active jamming signal may lap with the signal of choice, as a result may lead to C/N degradation of the signal of choice.
[0060] Therefore, the system of GSM (900MHz band) etc. cannot be used for distributing RF input signal or a station dispatch number using the phase shifter 51 about 90 degrees with a frequency multiplier 50 when there is severe specification over C/N. The example of drawing 6 is what corresponded in this case, and the 1st signal switch 52 and the 2nd signal switch (53) are formed, and it enables it for the phase shifter 51 to also detour a frequency multiplier 50 about 90 degrees by this about the signal which C/N wants to deteriorate (pass).
[0061] If it sees about the case of the common machine of two sorts of frequency bands, the object for now (900MHz band), for example, GSM, and the object for DCS1800 (1800MHz band), as described above, to the signal of choice, a GSM system is the frequency left 3MHz, and has been the very severe specification of inputting the active jamming signal of the big power of 76dBc.
[0062] In this case, oppression of signal 42a of the 1st image frequency and the signals 42b and 42c of the 2nd image frequency is difficult in DCS1800 system. Then, it is desirable to carry out this invention in this case using the signal distribution box SD equipped with the switch shown in drawing 6 .
[0063] Therefore, by applying the mixer circuit by the above operation gestalt to portable telephones which share two or more frequency bands, such as a "dual band machine", a "dual mode machine", or a "triple band machine", it is small and the portable telephone of high performance with which oppression of an image frequency component is fully obtained can be offered easily if needed.
[0064] By the way, according to this, in a portable telephone, usually carries out semi-conductor integration of a part of the circuit [at least], therefore what semi-conductor integration is carried out for as some portable telephones [at least] even if it faces application of the mixer circuit by this invention is a desirable operation gestalt, the need of choosing the engine performance of a filter which should be carried out external to a semiconductor integrated circuit twists, it is small and the semi-conductor integration circuit of high performance can be offered.

[Translation done.]

Drawing selection Representative drawing

【図１】



[Translation done.]

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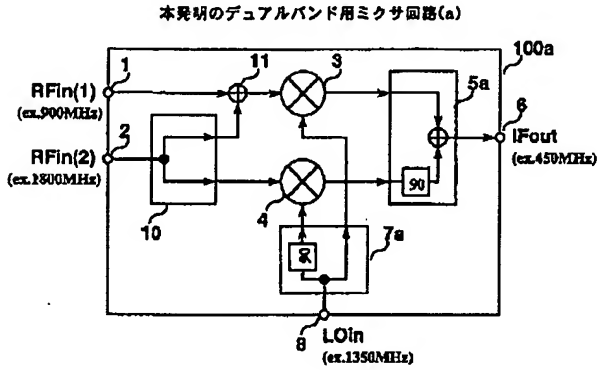
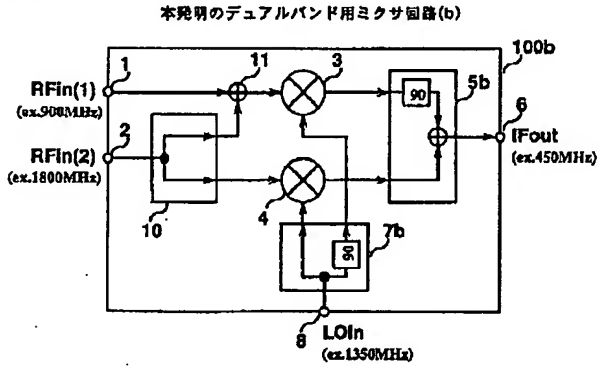
DRAWINGS

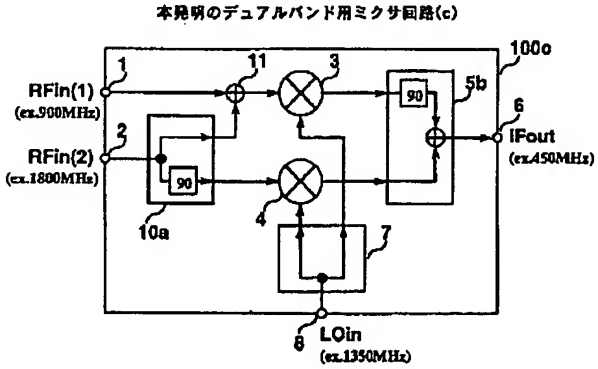
[Drawing 1]
【図1】



[Drawing 2]
【図2】



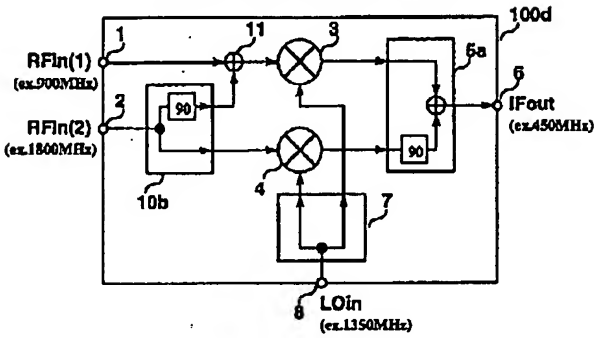
[Drawing 3]
【図3】



[Drawing 4]

【図4】

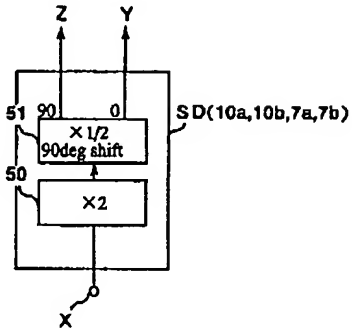
本発明のデュアルバンド用ミクサ回路(d)



[Drawing 5]

【図5】

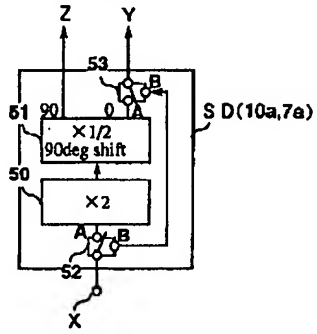
信号分配器の構成例



[Drawing 6]

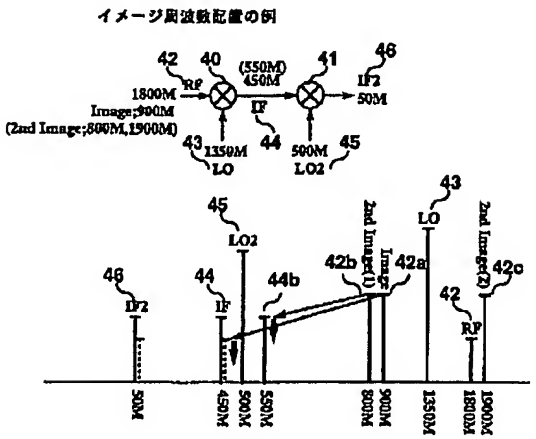
【図6】

信号分配器の別の構成例

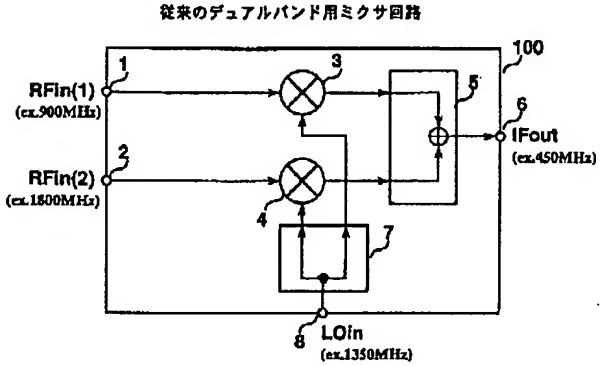


[Drawing 7]

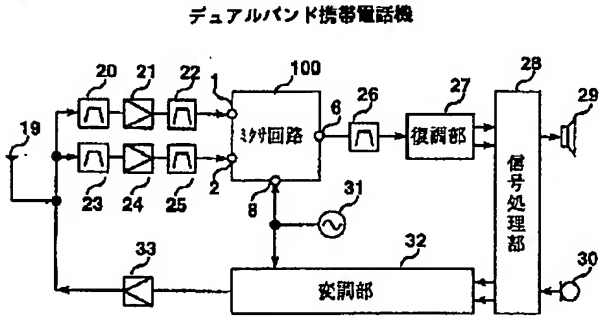
【図7】



[Drawing 8]
【図8】



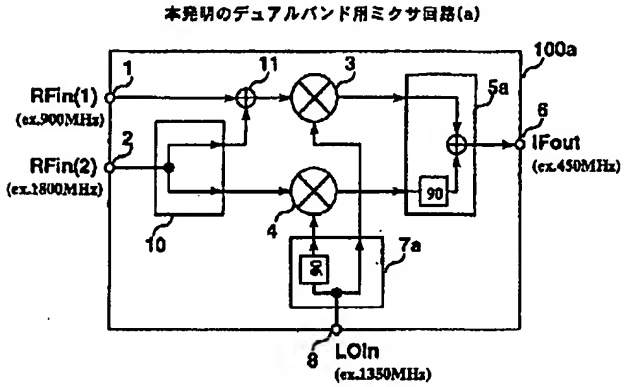
[Drawing 9]
【図9】



[Translation done.]

Drawing selection Representative drawing

【図１】



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the mixer circuit which oppresses an image frequency component, and the semiconductor integrated circuit which carried it in the portable telephone which used it, and the list, and is related in the suitable mixer circuit for the common portable telephone which can be used properly according to two or more sorts of especially different frequency bands and modulation techniques.
[0002]
[Description of the Prior Art] Recent years, GSM (Global system for mobile communications: worldwide magnitude mobile communication system), DCS1800 (Digital cellular system: digital partition system), PCS1900 (Personal communications system: individual communication system), PDC (Personal digital cellular 900/1500: individual digital partition system), AMPS (Advanced mobile phone service: the newest mobile radiotelephone service), Are represented by TACS (Total access communications system: comprehensive connection communication system) etc. The analog digital method cellular-phone system using the cellular-phone terminal of dc-battery actuation is continuing development increasingly, and is in the trend which does not know the place at which the high performance-ized demand of a pocket communication terminal also stops in connection with this.
[0003] And corresponding to the increment in such an assigned frequency band or system classification, common machines, such as a "dual band machine" which can talk two sorts of frequency bands over the telephone, and a "dual mode machine" which can be equivalent to two more sorts of different systems (a different modulation technique), appear by one set of a cellular-phone terminal, and, recently, the demand to a miniaturization and high-performance-izing of a circuit just increases **** in connection with this.
[0004] by the way, when realizing such a common machine, from the standpoint which controls the increment in circuit magnitude It is common to make from an antenna to a mixer circuit a wave number band response two or more rounds, and to use it in common about IF (Immediate Frequency: intermediate frequency) circuit after a mixer circuit. Therefore, henceforth [mixer circuit], two lines should just change in a part of demodulator circuit with "a dual mode machine, for example, the common machine of AMPS (FM modulation) and PCS1900 (GMSK modulation),."
[0005] Such a cellular-phone terminal corresponding to a dual band shows an example of the mixer circuit currently used from the former to drawing 8 R> 8. The mixer circuit 100 shown in this drawing 8 is constituted from the office input section 8 by two RF (Radio Frequency: high frequency) input sections 1 and 2, multipliers (for example, Gilbert Cell) 3 and 4, an adder 5 and IF input section 6, the office dispatch number distributor 7, and it, and enables it to correspond to two bands of GSM (900MHz band) and DCS1800 (1800MHz band) by this.
[0006] And the 900MHz RF signal RFin inputted into one input of each multipliers 3 and 4 from each input sections 1 and 2 (1) The 1800MHz RF signal RFin (2) is supplied the same, respectively. To the input of another side Station dispatch number LOin which was inputted from the input section 8 from a station, and was distributed by the station dispatch number distributor 7 It supplies, the output is added with an adder 5 in each, and the 450MHz intermediate frequency signal IFout is outputted from IF output section 6.
[0007] In this case, generally, an adder 5 serves as a collector addition method only by connection of wiring, and becomes twice one mixer circuit as the number of circuits (component). Moreover, since a matching circuit (filter) is surely required for RF input sections 1 and 2, and two or more lines of this matching circuit are required when inputting a different frequency, generally it is made such circuitry.
[0008] Drawing 9 is an example of the common machine corresponding to a dual band, and while was received by the antenna 19. A band a signal, for example, a 900MHz RF signal It is inputted into the filter 20 of the first rank, amplifier 21, and it through the latter filter 22 at RF input section 1 of a mixer circuit 100. The RF signal of the band of another side, for example, a 1800MHz RF signal, is inputted into the filter 23 of the first rank, amplifier 24, and it through the latter filter 25 at RF input section 2 of a mixer circuit 100.
[0009] And for example, it was outputted from IF output section 6 of a mixer circuit 100, the 450MHz intermediate frequency signal IFout is inputted into the recovery section 27 through a filter 26, and after getting over and being processed in the signal-processing section 28, it is supplied to a loudspeaker 29.
[0010] On the other hand, the sound signal inputted into the signal-processing section 28 will be supplied to the modulation section 32, will turn into a modulated RF signal from a microphone 30, the transmitting amplifying circuit 33 will be supplied, and it will be transmitted as an electric wave from an antenna 19. Station dispatch number LOin currently supplied to the mixer circuit 100 from the local oscillator 31 at the modulation section 32 at this time It is supplied and, thereby, transmit frequencies are specified.
[0011]
[Problem(s) to be Solved by the Invention] Consideration was not carried out about the point that the preceding paragraph of a mixer circuit takes the filter of high performance, but the above-mentioned conventional technique had a problem in buildup-izing and cost lifting of circuit magnitude accompanying a dual band response. Hereafter, if this point is explained in detail, as described above, now, for example If IF frequency is set to 1350MHz supposing the common machine of a 900MHz band (GSM) and two frequency bands of a 1800MHz band (DCS1800), 450MHz and the frequency from a station At this time, generally, in order to oppress an unnecessary interference out of band, equipment of the filter of a quite steep property becomes indispensable as filters 20, 22, 23, and 25 of the preceding paragraph of the mixer circuit 100 shown in drawing 9 .
[0012] Moreover, when the high frequency band side filters 23 and 25 are the same filter formats and the same magnitude (configuration)

compares in this case, as compared with the filters 20 and 22 by the side of a low frequency band, usually becomes that in which the oppression property out of band was generally inferior.
[0013] Then, on the occasion of a dual band response, a dielectric filter and the filter with which the steep and big magnitude of attenuation is obtained like a ceramic filter are needed insufficiently [the SAW (SurfaceAcoustic Wave: surface acoustic waves) filter usually used / a property]. Since mass production effectiveness was bad, as the deer was carried out and these dielectrics filter and the ceramic filter had the problem that a configuration will become large as compared with an SAW filter, and it described above as compared with the SAW filter, the problem that a price will also become high will arise.
[0014] Next, drawing 7 explains the interference component which becomes a problem especially here. Although the component of an interference changes with configurations of a receiving circuit, as shown in drawing on drawing 7 , it assumes the case of the double conversion method which carries out frequency conversion in two steps here using two mixers 40 and 41. In addition, in this drawing 7 , Hz which is the unit of a frequency is omitted, therefore M is MHz.
[0015] First, the 1st step of mixer 40 performs frequency conversion by the 1350MHz office dispatch number 43 (LO) into which 1800MHz RF signal 42 inputted from RF input section 2 as well as the multiplier 4 in the mixer circuit 100 of drawing 8 is inputted from the office input section 8, and outputs 450MHz IF signal 44.
[0016] Next, the mixer 41 of the 2nd step carries out frequency conversion of IF signal 44 which is the 1st step of output of a mixer 40 by the 2nd 500MHz station dispatch number 45 (LO2), and outputs 50MHz IF signal 46. In this case, it becomes the same frequency of 450MHz as IF signal 44 which is the output of the mixer 40 of the 1st step. 1st image signalling frequency 42a which is blocked to the wave of choice (First Image=LO-RF=900MHz), It becomes the same frequency (50MHz) as the output signal 46 (IF2) of the mixer 41 of the 2nd step. A kind of signal 42b in the 2nd image frequency which is blocked to the wave of choice (2= 800MHz of 2nd Image(1) =LO-LO2-IF), Since a kind of signal 42c (2= 1900MHz of 2nd Image(2) =LO+LO2+IF) which will accept it in the 2nd image frequency cannot be oppressed theoretically, it must be oppressed with the filter of the preceding paragraph from it in the usual mixer circuit.
[0017] Here about the RF signal by the side of a high frequency band (DCS1800) About the special frequency group which is in the range changed into the band of the wave of choice by frequency conversion of a mixer in a band 1705MHz [or less] and a band 1980MHz or more It is defined by specification that it can receive even when the interference of -43dBm power is inputted into the antenna of a cellular phone, therefore it fully needs to attenuate such a big signal to -100dBm - -110dBm in the mixer input section 2 as a flight model.
[0018] In order for image frequency 42a and a kind of frequency 42b of the 2nd image frequency to be in a kind of this special frequency group and to make it decrease these, if 70dB or more of magnitude of attenuation is made, 80dB or more of a certain things is needed for the filters 23 and 25 in the preceding paragraph by the side of the input section 2. A deer is carried out, since the magnitude of attenuation expectable in a general SAW filter is only about 30dB, even if it uses two steps of this, it will be insufficient, therefore 10dB - about 20dB is understood that it cannot but use a filter large [a dielectric filter, a ceramic filter, etc.] a configuration and expensive in the actual condition as mentioned above.
[0019] About other frequency 42c of a kind of of the 2nd image frequency, as the magnitude of attenuation with filters 23 and 25, although 10dB - about 20dB is needed, since it becomes near the receiving band in this case, whenever [oppression] will hardly be obtained, therefore the 10dB - 20dB magnitude of attenuation will be still more nearly insufficient also here.
[0020] The so-called image cancellation mixer circuit where oppression of such image frequency was obtained by the mixer circuit itself on the other hand is known from the former. As that name, this mixer circuit is a mixer circuit equipped with the function which oppresses image frequency, and has composition which added the adder etc. to two usual multipliers with the phase shifter about 90 degrees.
[0021] Supposing it carries out a deer and applies this image cancellation mixer circuit to the mixer circuit of a common machine, two multipliers are required only in one mixer circuit, if it is a dual band response for this reason, a total of three multipliers will be required and a word will increase [the number of circuit elements, and an area required for that arrangement] 1.5 times roughly. Moreover, since the adder of an output side serves as addition of three signals in this case, similarly wiring capacity increases 1.5 times and what the degradation by lowering of an output level will not escape can be guessed easily.
[0022] Without being accompanied by buildup of circuit magnitude, the object of this invention is to offer the mixer circuit where control of the interference by image frequency was fully obtained, and is to offer further the portable telephone with which high performance-ization was obtained by this mixer circuit.
[0023]
[Means for Solving the Problem] In the mixer circuit of the method which receives the input signal which differs in two or more frequency bands using the adder adding the output of two or more multipliers which carry out the multiplication of an input signal and the station dispatch number, and the multiplier of these plurality, respectively, and outputs an intermediate-frequency signal, at the time of the input signal reception by one certain multiplier of said multiplier, an image cancellation mixer circuit is formed using one multiplier of further others, and the above-mentioned object is made and attained.
[0024] In the common machine which operates with two or more frequency bands, while the multiplier corresponding to the signal of each frequency band exists in a mixer circuit and operating with which frequency band, multipliers other than a corresponding multiplier are in the condition of playing. Then, it enables it to oppress the interference of image frequency in this invention, without using this together, and hitting on an idea paying attention to existence of the idle multiplier in this common machine, that an image cancellation mixer should be constituted, consequently being accompanied by buildup of circuit magnitude.
[0025]
[Embodiment of the Invention] Hereafter, the operation gestalt of a graphic display explains this invention to a detail. Although drawing 1 is 1 operation gestalt of the mixer circuit by this invention, 100a of a mixer circuit and 10 is [an input signal distributor and 11] adders in drawing, and other configurations are the same as the mixer circuit by the conventional technique shown in drawing 8 as long as it saw with a block In this mixer circuit 100a, it replaces with the adder 5 in the mixer circuit 100 of drawing 8 , and adder 5a is prepared, similarly it replaces with the office dispatch number distributor 7, and office dispatch number distributor 7a is prepared.
[0026] Adder 5a consists of adder circuits which equipped one side of the two input path with the phase-shifting circuit of 90 degrees, and carries out the work adding the output signal of the multiplier 3 of a 900MHz band, and the signal which carried out the phase shift of the output of the multiplier 4 of a 1800MHz band 90 degrees. Station dispatch number adder 7a serves to carry out 90-degree phase shift of the 1350MHz station dispatch number, and to supply it to a multiplier 4 while it consists of circuits which equipped one side of the two output path with the 90-degree phase-shifting circuit and supplies a 1350MHz station dispatch number to a multiplier 3 as it is.
[0027] A distributor 10 serves to distribute the RF signal supplied from the input section 2 by the side of a high cycle band to a multiplier 4

and the input signal adder 11, respectively, and to supply it. The input signal adder 11 serves to mix the RF signal supplied from the input section 1 by the side of a low frequency band, and the RF signal by the side of the high cycle band supplied through a distributor 10, and to input into a multiplier 3.

[0028] Therefore, although mixer circuit 100a of this drawing 1 is 2 band response of GSM by the side of the low frequency band same with the mixer circuit 100 of the conventional technique shown in drawing 8 (900MHz band), and DCS1800 (1800MHz band) by the side of a high frequency band Although it becomes the same actuation as the conventional technique to the RF signal of GSM by the side of a low frequency band (900MHz band) at this time As opposed to the RF signal of DCS1800 (1800MHz band) by the side of a high frequency band It will operate as the above-mentioned image cancellation mixer circuit, and this oppresses 1st image frequency 42a and the 2nd image frequency 42b and 42c which were explained by drawing 7 .

[0029] if gain of the active jamming signal omegaIF (unwanted) and the multiplier which lap VImage and a station dispatch number with VLO and the wave of choice in 1st image signalling frequency 42a is now set to K here -- VImage=Acos (omegaImage-t) ..... (1) VLO=Bcos (omegaLO-t) .. .. (2) omegaIF(unwanted) =omega LO-omega Image .. .. it is set to (3).

[0030] If it does so, the output V1 of the 1st multiplier 3 will become as the following (4) types.

V1=A1 cos (omegaImage-t) and B1 cos (omegaLO-t), K1 = A1, B1, and K1/2, [cos{(omega Image+omega LO), and t} + cos {(omega Image-omega LO) -t}] =(A1, B1, K1) /2- [cos{(omega Image+omega LO) -t} +cos{omegaIF-t}] .... .. (4) [0031] Moreover, the output V2 of the 2nd multiplier 4 becomes as the following (5) types.

V2=A2 cos (omegaImage-t) and B-2 cos (omega LO-t+pi / 2), K2 = A2, B-2, and K2/2, [cos{(omega Image+omega LO) and t+pi / 2} + cos {(omega Image-omega LO) - t-pi / 2}] =(A2 and B-2, K2)/2 and [cos{(omega Image+omega LO) - t+pi / 2} +cos -- {(omega IF-t+pi / 2}] ..... (5) [0032]) Next, if it sees in the output of adder 5a about the active jamming signal component VIF (unwanted) which laps with the wave of choice, this will become the component which consists only of the 2nd term of (4) types and (5) types. Then, considering the actuation to this component, it becomes the following (6) types.

VIF(unwanted) =V1+V2**90=0 .... .. (6)

Therefore, it turns out that 0, i.e., this signal 42a, is oppressed, and the magnitude of signal 42a of the 1st image frequency is not changed into the frequency of the wave of choice. The same is said of the 2nd image frequency 42b and 42c.

[0033] By the way, in order to materialize (6) types in this case so that clearly from (4) types and (5) types, the following (7) types serve as requirements.

A1 and B1 -K1=A2, B-2, and K2 .... .. it is an indispensable condition for (6) type formation in (7), i.e., this operation gestalt, that the phase precision in each part can be taken exactly.

[0034] And the amplitude precision of two signals of the input signal distributor 10, phase precision and the amplitude precision of two signals of office dispatch number distributor 7a, phase precision, the gain precision of multipliers 3 and 4, and when the phase precision in 2nd adder 5a corresponds further and these are all satisfied, in mixer circuit 100a of drawing 1 , whenever [image about 40dB - 60dB oppression] is obtained by this condition.

[0035] By the way, in this way, when mixer circuit 100a by the operation gestalt of this invention is used, the 40dB - 60dB magnitude of attenuation can be obtained by this mixer circuit 100a itself. On the other hand, as described above, in the case of the common machine shown in drawing 9 , the magnitude of attenuation required for the filters 23 and 25 of the input section 2 by the side of a high frequency band is 70dB - 80dB, and the magnitude of attenuation of another side and a general SAW filter is about 30dB.

[0036] It can fully respond to a common machine, without fully being able to oppress signal 42a of the 1st image frequency, and the signals 42b and 42c of the 2nd image frequency, consequently using an expensive filter in big configurations, such as a dielectric filter and a ceramic filter, according to the operation gestalt of this invention, even if it will use a general SAW filter as filters 23 and 25 when this mixer circuit 100a is used if it does so.

[0037] And with this operation gestalt, the actuation by the side of a high frequency band is faced. Since the multiplier 3 by the side of a low frequency band is shared as some components of the mixer circuit by the side of a high frequency band Since it will end also with the case corresponding to a dual band with a total of two multipliers, and the increment in the number of circuit elements and an area required for the arrangement can be suppressed certainly and there is also no increment in the number of addition of the signal in the adder of an output side, fear of lowering of an output level is not produced, either.

[0038] By the way, although it constitutes from an operation gestalt of drawing 1 so that the actuation which is made to form an image cancellation mixer circuit only to one input between two RF-signal inputs, and oppresses an image frequency component may be obtained An image cancellation mixer circuit may be made to form also to any of an input, and since the mixer circuit which is not surely used exists in another side, you may constitute from such a common machine so that the actuation which oppresses an image frequency component may be obtained.

[0039] Moreover, with the operation gestalt of this drawing 1 , although the RF signal of DCS1800 (1800MHz band) inputted from the 2nd input section 2 is compounded to the RF signal of GSM (900MHz band) into which it is inputted from the 1st input section 1, the adder 11 is used. A deer is carried out, and a switch is used instead of this adder 11, two signals are changed, and you may make it input into a multiplier 3 in this invention. If a side [in the case of the operation gestalt carried out in this way, it is separated with a switch] is made into the 1st input section 1 side, since the impedance in this input can be brought close to opening infinite, the design of the matching circuit of the 1st input section 1 becomes easy, and can improve the engine performance easily.

[0040] Although it considered as the dual band response and the case of two RF-signal inputs was explained with the above-mentioned operation gestalt further again, you may make it three or more RF-signal input responses. In this case, actuation which oppresses an image frequency component in one line or two or more signal inputs will be carried out.

[0041] On the other hand, by the case corresponding to a dual band like the above-mentioned operation gestalt about the RF signal of GSM (900MHz band) inputted from the 1st input section 1 If it is made to operate as a usual mixer circuit only using the 1st multiplier 3 You may constitute so that supply of the current over component parts which are not used, such as the 2nd multiplier 4, may be turned OFF, and at the time of actuation by GSM (900MHz band), power consumption can be lessened in this case, and extension of the dc-battery operating time by energy saving can be obtained.

[0042] Furthermore, although it consists of above-mentioned operation gestalten so that an office dispatch number may be supplied from one set of a local oscillator 31 and may be distributed by the office dispatch number distributor 7, it is obvious that it has some office input sections if needed, and you may be distributed with some office dispatch number distributors if needed using two or more local oscillators.

[0043] Next, a point which drawing 2 is what showed mixer circuit 100b by the 2nd operation gestalt of this invention, and is different

from mixer circuit 100a by the operation gestalt of drawing 1 Replace with 2nd adder 5a and adder 5b by which the phase-shifting circuit is arranged from the multiplier 3 to the input path is prepared. It replaces with station dispatch number distributor 7a, and is in the point that station dispatch number distributor 7b which similarly arranges the phase-shifting circuit for the output path over a multiplier 3 is prepared, and other configurations are the same.

[0044] In this mixer circuit 100b, the output V1 of the 1st multiplier 3 becomes as the following (8) types.

V1=A1 cos (omegaImage-t) and B1 cos (omega LO-t+pi / 2), K1 = A1, B1, and K1/2, [cos{(omega Image+omega LO) and t+pi / 2} + cos {(omega Image-omega LO) - t-pi / 2}] =(A1, B1, K1) /2- [cos{(omega Image+omega LO) - t+pi / 2} +cos{omegaIF-t}+pi/2] ..... (8)

[0045] Moreover, the output V2 of the 2nd multiplier 4 becomes as the following (9) types.

V2=A2 cos (omegaImage-t) and B-2 cos (omegaLO-t), K2 = A2, B-2, and K2/2, [cos{(omega Image+omega LO), and t} + cos {(omega Image-omega LO) -t}] =(A2 and B-2, K2) /2- [cos{(omega Image+omega LO) -t} +cos{omegaIF-t}] .... .. (9) [0046] And about the active jamming signal component VIF (unwanted) which laps with the wave of choice, it becomes the component which consists only of the 2nd term of (8) types and (9) types with the output of adder 5b, and this serves as the following (10) types.

VIF(unwanted) =V1**90+V2=0 .... .. (10) Follow. 0, i.e., this signal 42a, will be oppressed, the magnitude of signal 42a of the 1st image frequency will be changed into the frequency of the wave of choice, and this is the same also about the 2nd image frequency 42b and 42c. It turns out that all will be oppressed, consequently the same operation effectiveness as the operation gestalt of drawing 1 is acquired also according to the operation gestalt of this drawing 2 .

[0047] Next, a point which drawing 3 is what showed mixer circuit 100c by the 3rd operation gestalt of this invention, and is different from mixer circuit 100b by the operation gestalt of drawing 2 It replaces with station dispatch number distributor 7b, replaces with the input signal distributor 10 using the station dispatch number distributor 7 without a phase-shifting circuit, and is in the point that input signal distributor 10a which arranges the phase-shifting circuit for the output path over a multiplier 43 is prepared, and other configurations are the same.

[0048] And in this mixer circuit 100c, the output V1 of the 1st multiplier 3 becomes as the following (11) types.

V1=A1 cos (omegaImage-t) and B1 cos (omegaLO-t2), K1 = A1, B1, and K1/2, [cos{(omega Image+omega LO), and t} + cos {(omega Image-omega LO) -t}] =(A1, B1, K1) /2- [cos{(omega Image+omega LO) -t} +cos{omegaIF-t}] .... .. (11)

[0049] Moreover, the output V2 of the 2nd multiplier 4 becomes as the following (12) types.

V2=A2 cos (omega Image-t+pi / 2) and B-2 cos (omegaLO-t), K2 = A2, B-2, and K2/2, [cos{(omega Image+omega LO) and t+pi / 2} + cos {(omega Image-omega LO) -t} +pi/2] =(A2 and B-2, K2) /2- [cos{(omega Image+omega LO) - t+pi / 2} +cos{omegaIF-t}-pi/2] ..... (12) [0050] And it becomes the component which consists only of the 2nd term of (8) types and (9) types about the active jamming signal component VIF (unwanted) which laps with the wave of choice with the output of adder 5b, and this serves as the following (13) types as well as the above-mentioned (10) types.

VIF(unwanted) =V1**90+V2=0 .... .. also according to (13), therefore the operation gestalt of this drawing 3 0, i.e., this signal 42a, will be oppressed, large ** of signal 42a of the 1st image frequency will be changed into the frequency of the wave of choice, and the same is said of the 2nd image frequency 42b and 42c. All will be oppressed, consequently the same operation effectiveness as drawing 1 and the operation gestalt of drawing 2 can be acquired.

[0051] Furthermore, a point which drawing 4 is what showed 100d of mixer circuits by the 4th operation gestalt of this invention, and is different from mixer circuit 100c by the operation gestalt of drawing 3 It replaces with adder 5b which has a phase-shifting circuit for the output path of the multiplier 3 by the side of a low frequency band. Adder 5a which has a phase-shifting circuit is used for the output path of the multiplier 4 by the side of a high frequency band. It replaces with input signal distributor 10a which arranges the phase-shifting circuit for the path which results in a multiplier 43, and is in the point that input distributor 10b which has a phase-shifting circuit for the path which results in an adder 11 is prepared, and other configurations are the same.

[0052] And in the case of 100d of this mixer circuit, the output V1 of the 1st multiplier 3 becomes as the following (14) types.

V1=A1 cos (omega Image-t+pi / 2) and B1 cos (omegaLO-t2), K1 = A1, B1, and K1/2, [cos{(omega Image+omega LO) and t+pi / 2} + cos {(omega Image-omega LO) - t+pi / 2}] =(A1, B1, K1) /2- [cos{(omega Image+omega LO) - t+pi / 2} +cos{omegaIF-t}-pi/2] ..... (14)

[0053] Moreover, the output V2 of the 2nd multiplier 4 becomes as the following (15) types.

V2=A2 cos (omegaImage-t) and B-2 cos (omegaLO-t), K2 = A2, B-2, and K2/2, [cos{(omega Image+omega LO), and t} + cos {(omega Image-omega LO) -t}] =(A2 and B-2, K2) /2- [cos{(omega Image+omega LO) -t} +cos{omegaIF-t}] .... .. (15) [0054] Therefore, since it becomes the component which consists only of the 2nd term of (14) types and (15) types with the output of adder 5b about the active jamming signal component VIF (unwanted) which laps with the wave of choice, this serves as the following (16) types as well as the above-mentioned (6) types.

VIF(unwanted) =V1+V2**90=0 .... .. also according to (16), therefore the operation gestalt of this drawing 4 0, i.e., this signal 42a, will be oppressed, large ** of signal 42a of the 1st image frequency will be changed into the frequency of the wave of choice, and the same is said of the 2nd image frequency 42b and 42c. All will be oppressed, consequently the same operation effectiveness as the operation gestalt of drawing 1 - drawing 3 can be acquired.

[0055] Next, the example of the station dispatch number distributors 7a and 7b in the above-mentioned operation gestalt and the input signal distributors 10a and 10b is explained. In addition, since each of these divides one signal into two signals, it has the same function to carry out a phase shift and to output about 90 degrees of one signals and each of the internal-block configurations can be made [therefore] the same, the case where all are considered as the same configuration is only hereafter explained as a signal distribution box SD.

[0056] First, drawing 5 is an example of a frequency multiplier 50 and the signal distribution box SD constituted using the phase shifter 51 about 90 degrees. A frequency multiplier 50 inputs the station dispatch number supplied from the input terminal X, or the RF signal by the side of a high frequency band, and serves to change and output the frequency twice. About 90 degrees, a frequency inputs the signal which it doubled and carries out 1 / 2 dividing of this inputted signal, and the phase shifter 51 is distributed to two sorts of signals which shifted the phase about 90 degrees simultaneously, and serves to supply to each of two output terminals Y and Z.

[0057] As a circuit which distributes one signal to two signals, shifts the phase of the signal of one of these 90 degrees, and outputs it to the phase of the signal of another side here, it is common to use a phase shifter about 90 degrees. Then, since dividing of the frequency of the signal into which the signal distribution box SD of this drawing 5 was also inputted by the phase shifter 51 about 90 degrees in this case using the phase shifter 51 about 90 degrees will be carried out to one half, the frequency multiplier 50 has been formed further.

[0058] Next, drawing 6 is other examples of the signal distribution box SD in the mixer circuit of this invention (10a, 7a). As described above, this signal distribution box SD distributes the inputted signal to two signals of 0 times and 90 degrees as a function. Therefore,

although it is thought that there is no degradation of C/N here since the signal of 0 times serves as a free line when it sees as a functional block diagram, the signal of 0 times will also surely pass along the phase shifter 51 about 90 degrees with a frequency multiplier 50, and a actual circuit can consider degradation of big C/N, as shown in drawing 5 and drawing 6 .

[0059] On the other hand, by the system of GSM (900MHz band), on the frequency left 3MHz to the signal of choice, even if it inputs the active jamming signal of the big power of 76dBc, to be able to receive is demanded as specification. In this case, the thing which the active jamming signal itself is turned up and lapped with the frequency of the signal of choice Although it is satisfactory since it is strictly prescribed by another specification, if C/N of an active jamming signal or the station dispatch number poured into a mixer circuit is bad Since 76dBc(s) have also inputted the active jamming signal of big power, there is a possibility that the noise level of the "skirt" which separated 3MHz from the center frequency of an active jamming signal may lap with the signal of choice, as a result may lead to C/N degradation of the signal of choice.

[0060] Therefore, the system of GSM (900MHz band) etc. cannot be used for distributing RF input signal or a station dispatch number using the phase shifter 51 about 90 degrees with a frequency multiplier 50 when there is severe specification over C/N. The example of drawing 6 is what corresponded in this case, and the 1st signal switch 52 and the 2nd signal switch (53) are formed, and it enables it for the phase shifter 51 to also detour a frequency multiplier 50 about 90 degrees by this about the signal which C/N wants to deteriorate (pass).

[0061] If it sees about the case of the common machine of two sorts of frequency bands, the object for now (900MHz band), for example, GSM, and the object for DCS1800 (1800MHz band), as described above, to the signal of choice, a GSM system is the frequency left 3MHz, and has been the very severe specification of inputting the active jamming signal of the big power of 76dBc.

[0062] In this case, oppression of signal 42a of the 1st image frequency and the signals 42b and 42c of the 2nd image frequency is difficult in DCS1800 system. Then, it is desirable to carry out this invention in this case using the signal distribution box SD equipped with the switch shown in drawing 6 .

[0063] Therefore, by applying the mixer circuit by the above operation gestalt to portable telephones which share two or more frequency bands, such as a "dual band machine", a "dual mode machine", or a "triple band machine", it is small and the portable telephone of high performance with which oppression of an image frequency component is fully obtained can be offered easily if needed.

[0064] By the way, according to this, in a portable telephone, usually carries out semi-conductor integration of a part of the circuit [at least], therefore what semi-conductor integration is carried out for as some portable telephones [at least] even if it faces application of the mixer circuit by this invention is a desirable operation gestalt, the need of choosing the engine performance of a filter which should be carried out external to a semiconductor integrated circuit twists, it is small and the semi-conductor integration circuit of high performance can be offered.

[0065]

[Effect of the Invention] Since one side of two multipliers required for exertion of image cancellation mixer ability was obtained by appropriation of the multiplier which it has as other objects for frequency bands according to this invention, by applying to a common machine, the increment in the number of circuit elements is suppressed, and the thing of it can be carried out, consequently a miniaturization and low-pricing of circuit magnitude can be attained easily.

[0066] Moreover, since according to this invention it can respond to severe regulation easily even if it does not use a large-sized and expensive filter, it is small and the common machine of high performance can be easily offered by the low price.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The mixer circuit characterized by to constitute in the mixer circuit of the method which receives the input signal which differs in two or more frequency bands using the adder adding the output of two or more multipliers which carry out the multiplication of an input signal and the station dispatch number, and the multiplier of these plurality, respectively, and outputs an intermediate-frequency signal at the time of the input signal reception by one certain multiplier of said multiplier so that an image cancellation mixer circuit may be formed using one multiplier of further others.
[Claim 2] The adder connected to at least two input sections (1 for example, 2) and one [at least] input section (for example, 1) of these input section (for example, 11), The input signal distributor which distributes the signal which connected with other input sections other than one [said] input section (for example, 2), and was inputted from this input section (for example, 2) to the 1st input signal and 2nd input signal of the respectively same phase (for example, 10), The 1st adder adding the signal inputted from said 1st input section (for example, 1), and the 1st input signal outputted from said input signal distributor (for example, 10) (for example, 11), The station dispatch number distributor which distributes the station dispatch number inputted from the input section from a station (for example, 8) to the 2nd station dispatch number in which the phase differed from the 1st station dispatch number of equiphase about 90 degrees (for example, 7a), The output of said 1st adder (for example, 11), and the 1st multiplier which inputs and carries out frequency conversion of said 1st station dispatch number outputted from said station dispatch number distributor (for example, 7a) (for example, 3), Said 2nd input signal outputted from said input signal distributor (for example, 10), The 2nd multiplier which inputs and carries out frequency conversion of said 1st station dispatch number outputted from said station dispatch number distributor (for example, 7a) (for example, 4), Carry out the phase shift of the output signal of said 2nd multiplier (for example, 4) 90 degrees, and the 2nd adder (for example, 5a) added to the output signal of said 1st multiplier (for example, 3) is formed. The mixer circuit characterized by constituting so that the intermediate frequency signal imagined and canceled may be acquired from this 2nd adder (for example, 5a).
[Claim 3] The adder connected to at least two input sections (1 for example, 2) and one [at least] input section (for example, 1) of these input section (for example, 11), The input signal distributor which distributes the signal which connected with other input sections other than one [said] input section (for example, 2), and was inputted from this input section (for example, 2) to the 1st input signal and 2nd input signal of the respectively same phase (for example, 10), The 1st adder adding the signal inputted from said 1st input section (for example, 1), and the 1st input signal outputted from said input signal distributor (for example, 10) (for example, 11), The station dispatch number distributor which distributes the station dispatch number inputted from the input section from a station (for example, 8) to the 2nd station dispatch number in which the phase differed from the 1st station dispatch number of equiphase about 90 degrees (for example, 7b), The output of said 1st adder (for example, 11), and the 1st multiplier which inputs and carries out frequency conversion of said 2nd station dispatch number outputted from said station dispatch number distributor (for example, 7b) (for example, 3), Said 2nd input signal outputted from said input signal distributor (for example, 10), The 2nd multiplier which inputs and carries out frequency conversion of said 1st station dispatch number outputted from said station dispatch number distributor (for example, 7a) (for example, 4), Carry out the phase shift of the output signal of said 1st multiplier (for example, 3) 90 degrees, and the 2nd adder (for example, 5b) added to the output signal of said 2nd multiplier (for example, 4) is formed. The mixer circuit characterized by constituting so that the intermediate frequency signal imagined and canceled may be acquired from this 2nd adder (for example, 5b).
[Claim 4] The adder connected to at least two input sections (1 for example, 2) and one [at least] input section (for example, 1) of these input section (for example, 11), The input signal distributor which distributes the signal which connected with other input sections other than one [said] input section (for example, 2), and was inputted from this input section (for example, 2) to the 1st input signal of equiphase, and the 2nd input signal with which phases differed about 90 degrees (for example, 10a), The 1st adder adding the signal inputted from said 1st input section (for example, 1), and the 1st input signal outputted from said input signal distributor (for example, 10b) (for example, 11), The station dispatch number distributor which distributes the station dispatch number inputted from the input section from a station (for example, 8) to the 1st station dispatch number of equiphase, and the 2nd station dispatch number (for example, 7), The output of said 1st adder (for example, 11), and the 1st multiplier which inputs and carries out frequency conversion of said 1st station dispatch number outputted from said station dispatch number distributor (for example, 7) (for example, 3), Said 2nd input signal outputted from said input signal distributor (for example, 10), The 2nd multiplier which inputs and carries out frequency conversion of said 2nd station dispatch number outputted from said station dispatch number distributor (for example, 7) (for example, 4), Carry out the phase shift of the output signal of said 1st multiplier (for example, 3) 90 degrees, and the 2nd adder (for example, 5b) added to the output signal of said 2nd multiplier (for example, 4) is formed. The mixer circuit characterized by constituting so that the intermediate frequency signal imagined and canceled may be acquired from this 2nd adder (for example, 5b).
[Claim 5] The adder connected to at least two input sections (1 for example, 2) and one [at least] input section (for example, 1) of these input section (for example, 11), The input signal distributor which distributes the signal which connected with other input sections other than one [said] input section (for example, 2), and was inputted from this input section (for example, 2) to the 1st input signal of equiphase, and the 2nd input signal with which phases differed about 90 degrees (for example, 10b), The 1st adder adding the signal inputted from said 1st input section (for example, 1), and the 2nd input signal outputted from said input signal distributor (for example, 10b) (for example, 11), The station dispatch number distributor which distributes the station dispatch number inputted from the input section from a station (for example, 8) to the 1st station dispatch number of equiphase, and the 2nd station dispatch number (for example,

7), The output of said 1st adder (for example, 11), and the 1st multiplier which inputs and carries out frequency conversion of said 1st station dispatch number outputted from said station dispatch number distributor (for example, 7) (for example, 3), Said 2nd input signal outputted from said input signal distributor (for example, 10), The 2nd multiplier which inputs and carries out frequency conversion of said 2nd station dispatch number outputted from said station dispatch number distributor (for example, 7) (for example, 4), Carry out the phase shift of the output signal of said 2nd multiplier (for example, 4) 90 degrees, and the 2nd adder (for example, 5a) added to the output signal of said 1st multiplier (for example, 3) is formed. The mixer circuit characterized by constituting so that the intermediate frequency signal imagined and canceled may be acquired from this 2nd adder (for example, 5a).

[Claim 6] In invention [which / of claim 2 thru/or claim 5] Said signal distribution box (for example, 7a, 7b), The frequency multiplier from which at least one of said station dispatch number distributor (for example, 7a, 7b) changes the frequency of the inputted signal twice (for example, 50), The mixer circuit characterized by consisting of phase shifters (for example, 51) about 90 degrees which inputs the output of this frequency multiplier, changes the frequency into one half, and is allotted for 2 minutes.

[Claim 7] In invention [which / of claim 2 thru/or claim 5] Said signal distribution box (for example, 7a, 7b), The frequency multiplier from which at least one of said station dispatch number distributor (for example, 7a, 7b) changes the frequency of the inputted signal twice (for example, 50), About 90 degrees distributed to the 1st which inputs the output of this frequency multiplier, changes the frequency into one half, and differs in a phase about 90 degrees, and the 2nd output A phase shifter (for example, 51), The mixer circuit characterized by consisting of switches (52 for example, 53) which output said inputted signal to said one side of the 1st and the 2nd output as it is.

[Claim 8] The portable telephone characterized by constituting using a mixer circuit given in any of claim 1 thru/or claim 5 they are so that it may operate with two or more frequency bands.

[Claim 9] The portable telephone with which said mixer circuit is characterized by being semiconductor-integrated-circuit-ized with some other circuit elements [at least] in a portable telephone according to claim 8.

[Translation done.]